SCIENCE.—SUPPLEMENT.

FRIDAY, FEBRUARY 5, 1886.

FISH AND FAMINE IN INDIA.

FAMINE seems to threaten with destruction the people of no part of the world so often as that of India; and the query has often arisen in the mind of the writer why the fish-food of that great empire was not utilized in its prevention to a greater extent. The vast peninsula of Hindostan is surrounded by tropical seas; its shores are low, and indented by lagoons; its interior is penetrated by great rivers; its list of edible fishes is an exceedingly long one. It would seem as though more account ought to be made of this food-supply than appears to be the case.

Fishermen have formed a separate caste in India from earliest times. Originally it was subdivided into those who pursued their calling in the open sea, and those who fished inland waters; but now this distinction is lost in most districts. The remains of a patriarchal organization of the caste — in whose history many figures prominent politically may be recalled — still exist, for the fishermen acknowledge several hereditary chiefs, each of whom exercises priestly control over a wide extent of coast, and is a final referee in all caste or family disputes. Subsidiary to them are lesser chiefs over groups of villages, and elective headmen presiding each over a single hamlet. These chiefs decide disputes, are present at marriages and religious ceremonies, often arrange the work of the village, collect government dues, and receive fines and fees, much of which the lower officers must pass on to their superiors.

The general degeneracy of the sea-fishing interest caused the Indian government recently to set on foot an investigation, which was placed in the hands of Dr. Francis Day, who recounted his results in an intelligent paper read before the late fisheries exhibition in London. It appears from this that the key to comparative prosperity or misery among this class of the population is found in the word 'salt.' The only object of getting sea-fish, which go in schools, and may be captured in large quantities at a time (beyond the trifle able to be consumed fresh on the shore), is to preserve them for subsequent use. This can be done by drying, which is an uncertain way, and results in greater or less putridity, or by the use of salt. Salt has not only been made from sea-water by native methods since ancient times, but in certain regions of the coast, as in western Madras, saline earths are found which form an imperfect substitute.

Former British rulers placed a heavy tax not only on the importation and manufacture of good salt, but even taxed the collection of the poor salt-earth: these impositions varied in different districts, and in some have been removed. Surveying the whole seacoast, it is now seen that wherever salt was dear, except in a few places supported by a brisk local demand (as in the vicinity of large cities), the fish-curer's trade was destroyed, and hence the fishermen were greatly depressed, decreasing in numbers, and seeking to become boatmen or sailors; that fish salted with taxed or monopoly salt was simply a luxury for the rich, and valuable as an export, so that the poor had to consume their fish putrid, or save it for a short time by immersing it in sea-water and drying in the sun; and that which is prepared with the salt-earth keeps badly, and predisposes the consumer to disease. The unmistakable result of this tax has been to discourage and lessen, if not wholly to ruin, a large proportion of the food-producing population of the empire. Moreover, it has brought about not only this special harm, but harm to the general public, whose food-supply is thus not only greatly diminished, but is put at an abnormally high price, since all the fishermen have now sunken into the hands of the money-lenders to whose advances of capital they owe their ability to do any thing at all, and to whom the whole catch must be turned over as soon as taken.

The fresh-water fishes differ in many respects from marine ones. Wherever any quantity of fresh water exists in the east, fishes are certain to be found, all the way from sea-level to near the summit of high mountains. In India this is particularly true, and the people fish in rivers, lakes, irrigation canals, tanks, ditches, swamps, and inundated fields; and, as fishing is a less laborious occupation than agriculture, the pursuit is in high favor in those ease-loving latitudes.

In olden times, under native rule, the fisheries were held as royalties, and mostly were let out to contractors, who retained the sole right to sell fish, but issued licenses, on payment, permitting families to catch for their own use. Remains of this custom, in one form or another, still exist. Along the Himalayas, in the Kangra and other districts, the petty rajahs adopted another plan,

selling licenses to supply the markets, and also to catch with small nets for table use. This was the plan in Burmah also, while the erection of weirs was greatly restricted, or, in some regions, prohibited altogether.

Under British rule these regulations have lost force, and notions once distinct as to fishing privileges and rights have become confused. At first fishermen and fishing implements were both taxed, besides the leasing fees of the fishing-grounds. Gradually these were removed, and many fisheries were made free; but this intended boon has proved an evil, as was the case with the sea-fisheries. Now the inland fisheries are open to all. When whole districts were let to contractors, they were not so short-sighted as to permit indiscriminate destruction; but now everybody does as he likes, when he likes, and how he likes. Every device that can be thought of is called into use. As soon as the monsoon has set in, and the fry begin to move, women and children daily search for them in all the sheltered spots to which they retire for rest or hiding. Nets that would not let a mosquito pass, and even solid cloths, are used for raking out the last one of these fingerlings. So soon as fish commence moving up the rivers for the purpose of breeding, so soon begins the work of destruction, aided by every implement of capture which human ingenuity can invent, not even excepting the scooping-up of whole deposits of fresh ova, and the wholesale poisoning of streams. When the few agile survivors have succeeded in running the gauntlet of weirs, traps, wicker baskets, and nets, of every size and shape, these are all reversed, and set in waiting for their return to the sea. The rod-fishing for mahaseer, the principal game-fish of northern India, is utterly ruined in many districts. Even fishes' eggs do not escape the general hunt to which the persecuted finny-tribes are subjected; for these are collected to be made into cakes, which are thought a great delicacy.

The result of all this heedlessness and indiscriminate destruction is already apparent, and is at last exciting the anxious attention of the rulers of India. The professional fishermen of the empire have decreased in numbers, and their villages are declining into deeper and deeper poverty. In the markets fish-food commands a higher rate than naturally belongs to it, and there is prospect of its steady rise. The longer this goes on, the more fish becomes a luxury for the rich, instead of a common resource for the poor, as seems to be its natural level; and it affords to other nations, as well as India, an example of the poor policy of placing no restrictions upon the harvest of sea and river.

Ernest Ingersoll.

THE MOUSE-PLAGUE OF BRAZIL.

It is well known that the fauna of America, especially that of the higher animals, presents a large number of peculiar types. Not only many of the lesser groups, but sometimes whole families of cosmopolitan orders, such as apes, opossums, etc., we find distinctly separated from those of the old world by some general peculiarity. The indigenous mice of America differ from those of the eastern hemisphere in some features of dentition, and also show a considerable variance in their habits.

The larger number of all the native species belong to a single genus, Hesperomys, of which in Brazil a dozen or more are known, differing in size from that of the ordinary mouse to that of the largest rat. They do not invade dwellings except under unusual circumstances, but mostly live in burrows of greater or less extent; some not less than seven or eight feet in length, widened at the end into a large excavation or chamber, which is filled with grass. They are omnivorous in their habits, feeding indifferently upon grass, seeds, and flesh. Their enemies are numerous, the more important of which are various snakes, and especially the tiger-cat and fox. A large dipterous insect, a bot-fly, is also parasitic upon many, the larvae of which are as large as the end of one's finger, and burrow beneath the skin.

Under ordinary circumstances they are not at all abundant, so that at times naturalists can secure specimens of many species only with difficulty. The almost inconceivable increase and abundance during certain years, to such an extent that they become a national calamity, is thus the more remarkable. In the colony of Lourenço one of these remarkable visitations has thus been described.[1] In the months of May and June, 1876, they suddenly appeared in enormous numbers. They invaded the maize-fields in such great numbers that the corn seemed literally alive with them, destroying in a few days every thing that was edible; and where, but a short time before, bushels of grain might have been harvested, not an ear remained, and the noise produced by their nibbling and climbing was audible for a considerable distance. After the corn-fields were devastated, the potatoes next received their attention. Only the largest were eaten in the ground: such as were transportable were carried away, and hidden in hollow trees or other retreats for future use. Gourds and pumpkins, even the hardest, were gnawed through and eaten. Of green food, such as clover, oats, barley, not a leaf was left standing:

[1] Zur kenntniss der brasilianischen mäuse und mäuseplagen. Dr. H. von Ihring, *Kosmos*, December, 1885.

even weeds were cut down, and the inner parts eaten out.

In the houses the struggle for existence of these long-tailed invaders was truly amazing. In many of the dwellings hundreds were killed in a single day. The cats could contribute but little aid, fighting such a plague; for not only were many of the rats so large that it would have been an unequal contest, but by their great number they drove the cats actually from the houses, not to return until the plague was passed. Nothing, except what was composed of iron, stone, or glass, was spared from their destructiveness: furniture, clothes, hats, boots, books, — every thing bore the traces of their teeth. They gnawed the hoofs of cows and horses in the stables, literally ate up fatted hogs, and often bit away the hair of persons during sleep. They penetrated all apartments, and gnawed their way through boards and walls of houses. Ditches that were dug about granaries did not suffice: the mice would climb over each other in some corner or other, and thus reach the top.

The foregoing account of one occurrence in Lourenço will suffice to show to what an extent the plague reaches. The same province had suffered similarly in 1843 and 1863, and in all probability will again in 1889. Our astonishment at the strange appearance and disappearance of such swarms of animal life is greatly increased when we perceive in what a close relation of cause and effect it stands with the presence or absence of food-supply; and probably nowhere among the vertebrate animals is the relation more apparent than here.

This food-supply is derived from the seeds of a large bamboo-grass (Taquary or Cresciuma) growing throughout Brazil. This grass grows in dense thickets to the height of thirty or forty feet, and bears a very large quantity of seed. Its natural history is remarkable. At regular intervals, varying in the different species from six to thirty years, it matures and blooms, and then disappears. Yet more remarkable is the uniformity with which it attains maturity throughout an entire province, if not the whole southern part of Brazil.

Similar plagues, though far less in extent, have occurred in Europe, in which the field-mice unaccountably appeared in greatly increased numbers. One may well think what would be the result were these little, almost insignificant creatures everywhere in such wise to take the ascendency. When one considers that on an average of every one or two months from five to eight young are born, and that these young become mature in a few months themselves, he will not be surprised to know that a single pair of the common field-mice, in the course of a single summer, would increase to twenty-three thousand individuals. Could all the conditions which now keep them in check be removed, every living thing upon the earth would be consumed in a half-dozen years.

BEE-HIVES AND BEE-HABITS.

ONE of the substantial improvements in bee-hives made in the last few years is the arrangement whereby the frames holding the combs can be quickly and easily turned up side down. The best arrangement of the several tried is where the rectangular frame holding the comb revolves on pivots fastened at the central point of the end-bars, within a half-frame just enough larger to permit the full frame to turn. The half-frame has the projecting top-bar of the usual Langstroth frame, and the half end-bars receive the pivots of the inner frame at their lower ends. Two years' experience shows me that these frames are a success.

But why this inversion of frames and combs in the hives? As is well known, bees only attach their combs firmly at top and upper portions of the lateral edges. It is probable that in past ages our honey-bees attached their combs to limbs of trees, as Apis dorsata does to-day, and as our honey-bees do in exceptional cases: hence the strong instinct to attach firmly above, slightly at the sides, and not at all below. By inverting the frames we take advantage of this habit, and secure firm attachment on all sides, thus making the combs secure for shipping, and less apt to break out when we are extracting or manipulating them for any purpose.

Another invariable habit with bees is to place their brood below the honey in the combs. Thus we always find honey at the top of the comb, and the brood at the bottom. Every bee-keeper is also aware that it is not always easy to induce the bees to leave the brood-chamber below, and pass to the sections above, when we desire to secure the comb-honey. But it is found, that if we invert our frames just as the honey harvest commences, thus throwing the honey below the brood, the bees at once, true to their instinct, pass into the sections, as they wish honey above their brood; and so we not only get the freshly gathered stores, but the honey previously stored in the brood-chamber carried into the sections above, just where we desire it, and all space below vacated for the brood, which is also desirable.

Not only is it desirable to invert the brood-frames, but the sections as well. This secures more firm attachment of the combs in the sec-

tions, and hastens the filling and capping, which is always more quickly and speedily done at the top than at the bottom. It is more than likely that the future hive will be so constructed that the entire hive, as well as the crate holding the sections, can be inverted at pleasure. This will give all the advantages named above with the least possible expense of time. The changing of the comb does no injury in any way, and is thought, by those who have tried it most, to prevent swarming. Turning the combs over causes the bees to tear down the queen-cells.

The late Mr. Samuel Wagoner suggested that the laying of fecundated eggs (those which develop into females) or unfecundated (those which produce drones) was automatic, and not an act of volition. The small worker-cells, he said, would compress the queen's abdomen, and thus force the sperm-cells from the spermatheca, and the eggs would be impregnated. The larger drone-cells would fail to exert this necessary compression, and so the eggs would pass unfecundated.

Bee-keepers now generally think that the queen is no such machine. Why the muscular apparatus connected with the spermatheca, except that it is to be used voluntarily to extrude the spermatozoa as the queen may desire? Sometimes worker-cells just started receive eggs which always develop into worker or female bees. Here the cells could not compress the queen's abdomen. The queen also lays fecundated eggs in the queen-cells, which are larger even than the cells which receive the unfecundated eggs, — the so-called drone-cells. That this act of adding or withholding the sperm-cells from the eggs is an act of volition on the part of the queen, is further proved in the fact that young queens, just beginning to lay, often scatter drone-eggs here and there in worker or the small cells. These, of course, produce drones, which only vary from the usual drones in their smaller size, which is necessitated by the smaller cells. This is obviously a mistake, and seldom occurs after the first two or three days of the queen's life. Now, may we not consider this the result of inexperience, the mistake of a novice? The queen has never yet used the complex muscular apparatus of the spermatheca, and at first fails in her attempt to work it satisfactorily. Soon she gains by experience, and makes no more failures. To assert this is no more irrational than to say that a colt will stumble and fall when it first begins to walk.

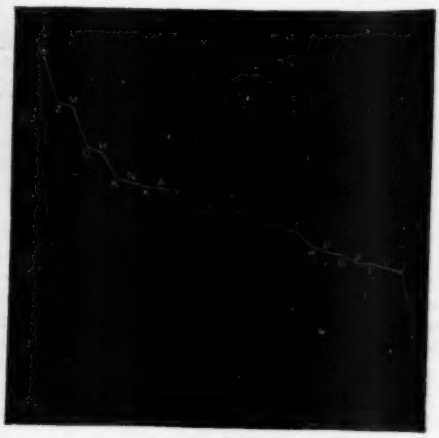
The observations of Sir John Lubbock and others as to wasps bear directly on this question. He finds that the mother-wasp invariably stocks the cell where the unimpregnated egg — the one that is to produce the male, which is considerably smaller than the female — is deposited with a less number of insects than the one where the impregnated egg which is to develop into a female is placed. Here we see that the mother-wasp not only knows the kind of an egg she is to lay, but she provisions the cells with exact reference to the necessities of the case. As the wasp puts just so many insects in each cell, it is evident that she has learned to count. Who shall be so prejudiced as to say that her waspship does not consider her act in laying the special egg, and does not think and plan her maternal acts looking to the larders of her yet unborn? We all know how close the relationship between wasps and bees is. Now, if a wasp realizes what she is doing as she adds or withholds the sperm-cells, to such an extent that it influences her daily acts, and modifies her performance of daily duties, who shall say that the queen-bee, of higher development and structure, does not think upon her acts as she places the eggs in worker or drone cells? Here, then, is another proof that egg-laying with the queen is a matter of intelligent volition; and far be it from me to say that the queen does not consider the size of her home, the size of her family, and the condition of her larder, as she passes in stately mein over the combs, stocking the worker or drone cells as circumstances dictate. If such volition and discretion are exercised, it makes plain many peculiarities noticed in studying bees. It makes it easy to understand why there is so much variation as to the swarming-habit, drone-production, etc., of different colonies of bees. Each queen has her own notions.

A. J. Cook.

LEGIBILITY OF LETTERS OF THE ALPHABET.

Mr. James Cattell has recently published in *Mind* the results of studies upon brain and eye inertia, of which the following will be found of interest. Some alphabets are harder to see than others, and the different letters of the same alphabet are not equally legible. Reading is one of the largest factors in our modern life, but at the same time a thoroughly artificial act. Here, as everywhere in nature, the organism shows its power of accommodating itself to its environment; but the large percentage of children who become shortsighted and weak-eyed, and suffer from headaches, gives us sharp warning, and puts us on our guard, lest these diseases become hereditary. Considering the immense tension put, of necessity, upon eye and brain, it is of the most vital

importance to relieve them by using the printed symbols which can be read with the least effort and strain. Experiments are not necessary to show that books (especially school-books) should be printed in large, clear type; but experiments may lead us to determine the most favorable type. It seems probable that the use of two varieties of letters, capital and small, is more of a hurt than help to the eye and brain. All ornaments on the letters hinder: consequently the German type is injurious. The simplest geometrical forms seem the easiest to see. The lines must not be too thin. We seem to judge the letters from the thick lines, and it is doubtful whether it is advantageous to use thin and thick lines in printing. From all these considerations, it seems that our printing-press has not improved on the alphabet used by the Romans. "Our punctuation-marks are hard to see, and, I think,



quite useless. It seems to me far better to replace (or, at all events, supplement) them by spaces between the words, corresponding in length to the pauses in the thought, or, what is the same thing, to the pauses which should be made in reading the passage aloud. Such a method of indicating to the eye the pauses in the sense would not only make reading easier, but would teach us to think more clearly.

"As I have already stated, not only are some types harder to see than others, but the different letters in the same alphabet are not equally legible." It was found that certain letters were usually correctly read, whereas others were usually misread or not seen at all. Fifty-four series were made with the capital Latin letters: consequently each letter was used 270 times. Out of this number of trials, *W* was seen 241 times, *E* only 63 times. The relative legibility of the different letters is clearly shown in the figure, in which the ordinates are taken proportional to the number of times each letter was read correctly out of the 270 trials.

Certain letters, as *S* and *C*, are hard to recognize in themselves; others are mistaken for letters similar in form, as in the case of *O*, *Q*, *G*, and *C*. The great disadvantage of having in our alphabet letters needlessly difficult to see will be evident to every one. "If I should give the probable time wasted each day through a single letter, as *E*, being needlessly illegible, it would seem almost incredible; and, if we could calculate the necessary strain put upon eye and brain, it would be still more appalling." Now that we know which letters are the most illegible, it is to be hoped that some attempt will be made to modify them. Our entire alphabet and orthography need recasting: we have several altogether useless letters (*C*, *Q*, and *X*), and there are numerous sounds for which no letters exist. In modifying the present letters, or introducing new forms, simplicity and distinctness must be sought after, and experiments such as these will be the best test.

"Experiments made on the small letters show a similar difference in their legibility. Out of a hundred trials, *d* was read correctly 87 times, *s* only 28 times. The order of distinctness for the small letters is as follows; *d*, *k*, *m*, *q*, *h*, *b*, *p*, *w*, *u*, *l*, *j*, *t*, *v*, *z*, *r*, *o*, *f*, *n*, *a*, *x*, *y*, *e*, *i*, *g*, *c*, *s*. As in the case of the capital letters, some letters are hard to see (especially *s*, *g*, *c*, and *x*) owing to their form; others are misread, because there are certain pairs and groups in which the letters are similar. A group of this sort is made up of the slim letters *i*, *j*, *l*, *f*, *t*, which are constantly mistaken the one for the other. It would not perhaps be impossible to put λ in the place of *l*, and the dot should be left away from *i* (as in Greek). It seems absurd, that, in printing, ink and lead should be used to wear out the eye and brain. I have made similar determinations for the capital and small German letters, but these should be given up. Scientific works are now generally printed in the Latin type, and it is to be hoped that it will soon be adopted altogether. At present, however, it is impossible to get the books most read (Goethe, for example) in Latin type."

BLONDES AND BRUNETTES IN GERMANY.

WITHIN the last few years the German government has authorized a commission, at the head of which is Professor Virchow, to collect statistics in

the interests of anthropology on the relative proportions and geographical distribution of blondes and brunettes in the German empire. Before the Anthropological congress at Carlsruhe, Professor Virchow gave an account of the results of these observations, illustrating his remarks by diagrams. An account of the study, together with the illustrations, will appear in full in Germany.

The study included all children of school age throughout Germany. Those only were classed as blondes who had light hair, blue eyes, and a fair complexion. The brunettes included those who had black hair and eyes, though the complexion might be more or less fair. All others were classed as mixed, including those with gray eyes. It is to be regretted that the same method was not followed in Belgium, where similar studies had been in progress, so that a direct comparison could be made.

Thirty-two per cent, or almost a third of the German youth, are blondes; 14 per cent are brunettes; while all the rest, 54 per cent, must be classed as mixed. This mixture is not a homogeneous one, but includes all intermediate varieties. One class of the German population forms a decided exception to these averages, viz., the Jews. Jewish children show only 11 per cent of blondes, but 42 per cent of brunettes. Their greater purity of race is shown by the small ratio of the mixed class amongst them. The blond type is particularly prevalent in Oldenburg and the neighboring more northerly communities: it is rarest in eastern Bavaria and in Alsace. A canton (Wildeshausen) in Oldenburg has 56 per cent of its population blondes, while Roding, a town in the second group, has only 9 per cent, a difference of 47 per cent. The former has only 4 brunettes to each 100 inhabitants, while a southern town in Alsace has as many as 81 to 100. The distribution of the blond type is much wider than that of the brunette type, which is only a secondary type. A canton in Wurtemberg shows the largest ratio of the mixed class, 60 per cent, while Pomerania shows the smallest, 40 per cent. The same contrast between the north and the south is shown in Belgium and in Switzerland. In southern Austria the brunette type is especially marked, but here the mixture with the Slavic people adds a complication.

What is the origin of this dark race amongst the Germans? Ancient writers describe them as having fair hair and eyes. One can assume that the immigrating races were of two types,—blondes and brunettes. But this would not account for the present geographical distribution, or perhaps a gradual transformation has taken place: this is improbable, because the climatic and other differences between north and south Germany are not sufficient to bring about such marked differences. The true explanation is suggested by the large proportion of the mixed class. The Germans were blondes, and spread to the east and south as such; but in Switzerland and Alsace they encountered a dark race, which was not expelled, but forced a mixture with the conquering race. The gray eyes are an indication of this great mixture of types, and not a mark of a third type. The questions regarding the brunette type must be resolved into a series of secondary problems connected with the general development of all the types. It must also be remembered that the characteristics by which the Germans have been described are not peculiar to them, but are common to other anthropologically different nations, of which the Finns are an example. Professor Virchow expressed the opinion that a comparative study of this question in different European nations would be of great importance.

DEFORMITIES OF BONES AMONG THE ANCIENT PERUVIANS.

Nearly fifty years ago Dr. v. Tschudi, in the disinterment of a number of Indian graves in the vicinity of Lima, found one containing the parts of three skeletons, in which the bones showed peculiar deformities, due to disease. The graves were near the famed temple of Pachacamac; and from the position, as well as the associated objects, Tschudi determined them to belong to one of the earlier epochs of the Incas, in the thirteenth century of the Christian era. From the accounts given by the native Indians, Tschudi learned of other graves, farther south, in which numerous skeletons with similar deformities had been found, and from which he concluded that persons thus afflicted had been buried together, as has been more recently done with the bodies of those dying from cholera.

These specimens were studied a few years later by Zschokke, who found the deformations so different from those produced by other known causes, that he pronounced the disease a new one. Very recently, however, the bones have come under the examination of Professor Virchow,[1] who has determined the cause to have been the affection described under the name of 'multiple exostosis.' This disease is one of the rarest known, and has only been recently studied and described. It is due to abnormal development, and appears most frequently near the ends of the long bones, resulting in remarkable growths, sometimes as

[1] Ueber krankhaft veränderte knochen alter Peruaner, von Rud. Virchow, *Sitzungberichte d. k. preussischen akad. d. wissenschaften*, 1885, p. 1129.

spongy masses, at other times as long, firm, ivory processes of the most varied shapes, several inches or more in length. The disease is more or less hereditary, nevertheless its apparent frequency among the ancient Incas is interesting.

Of more especial interest, however, is the relation which Virchow surmises to exist between this multiple exostosis and the bony growths found with remarkable frequency in the ear-canals of the ancient Peruvian crania. Nearly two scores of specimens have been described, in which either one or both auditory canals were more or less filled with bony growths, usually near the middle. As in nearly all these cases the peculiar flattening or elongation of the occipital region occurs to a greater or less extent, some have assigned this as the cause. Others have thought that the custom, so common among the Incas and other non-civilized races, of wearing rings or large disks of metal in the fleshy ear, had produced the affection. To both of these views Virchow objects. Not only have cases been observed among the North American Indians where there is no cranial deformation, but in the Incas themselves deformed skulls without, and undeformed skulls with, the exostosis, are known. The very common custom among many races of the present day, of wearing foreign substances in the ears, is not known to produce this result. The author believes them to be due to abnormal ossification, of a nature either closely related to, or identical with, that in other parts of the skeleton. Why this disease should have occurred with such greater frequency among this race we do not know, and we can only speculate upon the extent that it affected the audition. The effects of the disease must have been produced in childhood, probably early. In many cases the auditory canal is entirely closed on one or both sides, in others much narrowed. That it must have diminished the power of hearing, is evident. To what extent absolute deafness was caused, one cannot say.

LARGE VERSUS *SMALL TELESCOPES.*

THE critical observer can hardly fail to have noticed, during the past few years, the setting-in of a slight reaction against the monster telescopes and their capacity for advanced astronomical work. Perhaps this is not better defined at present than a tendency to reaction merely; and it seems to have had its origin mainly with a few possessors of medium-sized instruments, who, perhaps, had failed in their efforts to procure larger ones. Any astronomer who has had experience in the adaptation of different kinds of observational work to the varying capacity of different instruments knows very well that there is work enough of a sort which the largest telescopes only are fitted to perform in the best manner; and he also recognizes the fact that in other times of research, which are happily by no means exhausted, the small telescopes have many advantages over the large ones. But these relate rather to the mechanical than to the optical parts of the telescope.

It is not too much to say that the methods peculiar to the opticians of the present day have advanced the construction of the telescope to a degree of perfection which far surpasses the apparent possibilities of observational astronomy in other directions. If the optician gives the astronomer a practically perfect instrument, and the latter finds its performance disappointing, one or other of three things will be true: either he has set it up in a bad atmosphere, or the work to which he has put the instrument is ill adapted to its size, or (it is a good thing for every ambitious fledgling to institute this modest though often disastrous inquiry) the trouble resides in the cerebro-optical apparatus just outside the eye-piece. The first of these conditions appears in a fair way to be partially removed in the early future by the building of mountain observatories in regions where great steadiness of the upper atmosphere is insured; the second gradually removes itself with every new experience; while the third constitutes a very serious obstacle to the progress of the sciences; for what can the conscientious astronomer do with the work of a bad observer? He hesitates to mingle bad observations with good ones, for he cannot tell how much the accuracy of the final result may be impaired; nor does he like to reject the bad ones, because his work is then open to the charge of incompleteness; and, besides, the bad observer makes it an invariable rule to omit all data which might help the theoretical astronomer to find out just how bad his observations are.

Until lately, those who have been discussing in astronomical journals the relative merits of large and of small telescopes have quite overlooked the astonishing variation in the eye-power of different observers. As a general rule, — and for a very obvious reason, — the large telescopes come into the possession of the best observers, while the weaker eyes and heads must continue their use of the smaller instruments. Notwithstanding this natural result of evolution, the lesser telescope sometimes seems to have the greater advantage. While fully realizing the superior power of the great telescope, the observer using it has learned to be very cautious in pronouncing upon what he sees: but the imaginative amateur is bound by no such restrictions; he is free to conceive what

ought to be there, points to his spy-glass, and, lo! there it is. If, then, a trained observer with a larger telescope fails to verify his marvel, what better proof is needed that the great telescope is ineffective? It is an axiom in astronomy, that, when once a discovery is made with a large telescope, the object can always be seen with a smaller one. This presumes, of course, that the same observer uses the two instruments, and that he knows where to look and what to look for with the smaller one. And this in no wise constitutes an argument for equality of the small telescope with the larger; for with a good atmosphere, and the superior telescopes now made, it is never true that the nature of any celestial object can be made out with a small telescope which a larger one will fail to show more satisfactorily. Taken in connection with the attempts of late years, so far successful, to set up powerful telescopes on mountain elevations where a correspondingly perfect atmosphere is obtained, the future of the monster telescope is most hopeful. D. P. T.

MAKING A NEW MERV OASIS.

The Russians have fixed their minds, says *Engineering*, on a new enterprise, well calculated to set on edge the teeth of English and Indian statesmen. This is no other than the formation of a new oasis, as large as that of Merv, along the new frontier to the Oxus, which the Afghan delimitation commission will delineate as soon as the spring weather enables it to quit its winter quarters at Tchamshambe. Briefly, the scheme, which is said to be a sober engineering design, complete in all details, and drawn up on the spot by the surveyors of General Annenkoff, the constructor of the Transcaspian railway, provides for cutting the bank of the Oxus near Tchardjni, and allowing the water to flow afresh through some ancient channels running in the direction of Merv.

There is no particular novelty in the idea, the oasis of Khiva being formed entirely of country irrigated by an elaborate system of canals running out from the Oxus near its entrance into the Aral Sea, while the Merv oasis is of a similar character, and uses up all the water of the Murghab. The channels, we have said, already run into the desert near Tchardjni; and a careful series of levels, taken during the autumn, show, that if the bank of the river be cut, and the channels cleared of drift in one or two places, the water will run freely for sixty or seventy miles. The nomads can then be left to manage the rest of the business themselves; for the natives of Merv and Khiva are extremely clever in making irrigation canals, and they would speedily establish a network, and convert the clayey expanse now devoid of vegetation into a green oasis, as fertile as any in central Asia.

Readers of O'Donovan's and Marvin's books on Merv will not have forgotten, that as far as the Turcomans convey water from the Murghab, there amazing productiveness prevails, although immediately beyond is a desert. All that is really needed, therefore, is to withdraw from the Oxus a sufficient quantity of water (and Annenkoff's calculations show that abundance can be spared), and a year would be sufficient to create an oasis capable of supporting a quarter of a million people. In that case Russia could march troops from Askabad and Merv to the farthest parts of Turkestan, and despatch the Tashkent and Samarcand forces through Bokhara to Merv and Sarakhs in return, without having any desert to traverse. and the communications along the new frontier would be perfect. As the cost would be only £160,000, no doubt whatever is entertained in Russia that Annenkoff's proposal will be accepted.

Dr. Aristides Brezina of Vienna has published a catalogue of the fine collection of meteorites in the Hofkabinet. The richest collections of meteorites are those of the museums of London, Vienna, Paris, and Calcutta. On May 1, 1885, the Vienna collection contained representations of 358 genuine falls. Dr. Brezina accompanies his catalogue by a valuable essay on the origin and classification of meteorites, and by a map of the world showing the localities in which the Vienna specimens have been found.

— The *Revue sud-américaine* of Dec. 30 announces the organization of a new scientific society in Paris under the name, 'Académie de l'Amérique latine.' The academy will be divided into four sections, as follows: social and political; historical and literary; geographical and ethnographical; economical, commercial, and financial. It will be devoted solely to the Latin nations of America, and the membership will be unlimited. It will publish a bulletin in the French, Spanish, and Portuguese languages.

— Extended researches by F. Emich (*Centralblatt für agrik. chemie*) show that the purification of natural waters is effected almost wholly by organic agencies; the chemical action of ozone, peroxide of hydrogen, and the oxidation from the air, exerting but a feeble influence. This was proved by experiments made upon water in which the germs had been destroyed by boiling.